

## IMSSA: Creating an International Standard for Motor Software

Aimee McKane, Phone: 518-782-7002, Fax: 518-782-0556, E-Mail: atmckane@lbl.gov

John Mollet, Richard Aylwin, Paolo Bertoldi, John Cockburn, Chris Cockrill

### Abstract

The International Motor Selection and Savings Analysis (IMSSA) software tool was developed as a direct result of discussions at a previous EEMODS conference concerning methods to promote use of energy-efficient motors. Building on experience with existing software, such as MotorMaster+ (U.S.) and Eurodeem (Europe), an international collaboration was formed to develop software that would provide a universal, flexible software shell adaptable for use in any country in any language. Through the support of the sponsoring organizations: Corporacion Nacional del Cobre de Chile (Codelco); the UK Action Energy (Carbon Trust), the European Community – JRC; Natural Resources Canada; the US Department of Energy; and the International Copper Association, IMSSA seeks to provide industrial users of motor systems with greater access to performance and decisionmaking information concerning energy efficient motors. In addition, the focus on international collaboration provides a unique environment for further dialogue on about the global harmonization of motor testing and energy efficiency standards.

This paper will examine 1) the process of developing the software by the sponsors in cooperation with Washington State University; 2) key features of the software, such as software shell flexibility and functionality, multiple databases, language and currency modules; 3) issues in creating and maintaining IMSSA for international use; 4) how the software can be used to support efficiency standards and labels; and 5) the sponsors' experiences with launching the software in Canada, Chile, the United States, and Europe. A status report on new users of the software will be provided as well as plans to extend the use of the software to additional host countries and equipment manufacturers and distributors.

## 1 Introduction

The idea to develop international collaboration that would produce an international motor analysis and selection tool was put forward by Paul Scheihing, U.S. Department of Energy (USDOE); Dr. Hugh Falkner, from what is now UK Action Energy (formerly ETSU), and John R. Mollet, International Copper Association (ICA) at the 1999 EEMODS conference in London, UK. At this meeting, the principals identified an opportunity to work together to create an internationally-accepted software shell for motor analysis and selection that would provide both motor manufacturers and users of industrial electric motors with a common global platform for reporting and reviewing information concerning motor energy efficiency and related motor performance data. The primary purpose of this global platform is to encourage greater use of energy-efficient industrial electric motors and to increase the awareness of motor system efficiency worldwide. A secondary goal of international collaboration is greater communication concerning global variations in motor test standards for the purpose of promoting increased harmonization among those standards.

Motor systems account for a large fraction of the total energy consumption, for example, 60% of the US industrial electricity. On a global basis, industrial motor systems account for approximately 73% of all electricity used in manufacturing.<sup>1</sup> Tremendous energy savings and emission reductions can be realized by selecting more energy-efficient motors and by following better motor system management practices.

At the time of project initiation, the global market offered motors rated with different test standards (Institute of Electrical and Electronic Engineers -IEEE, International Electrical Commission -IEC, Canadian Standards Association-CSA, the Japanese standard-JEC. Today, the CSA, JEC, and IEC test standards are either similar to IEEE or are being revised to achieve closer harmonization as a way to increase test accuracy, international trade and competitiveness. However, it is also a fact that most countries still apply the older IEC 34-2 test method for determining energy efficiency.

In an effort to promote greater use of energy efficient motors, the U.S. and the European Union had each developed motor-management software, MotorMaster+ and Eurodeem, respectively. Other motor selection tools had been developed in Chile, Mexico, Brazil, and Poland. But with the increasing globalization of the market for industrial motors, the project sponsors realized that the proliferation of individual tools might not be the best approach for this market. In addition, neither equipment providers nor users alone can bridge the inherent differences in standards, units, frequency, motor models, and utility structures among the different countries.

An international motor systems software tool was envisioned to address these issues. This software would be flexible enough to serve the needs of developing as well as developed countries. A further benefit of such a tool would be support for the ongoing process of standards harmonization. Collaborative development of the software would allow the participants to leverage funding and expertise to develop the best overall product accomplished with minimum resources.

## **2 Forming the Collaboration**

To initiate the collaboration, a letter of intent and a project description were prepared in late 1999. The letter of intent invited sponsors to participate in a Steering Committee to provide direction in the development of the project. In addition to the ICA, government-affiliated organizations from industrialized countries interested in participating were invited to sign a letter of intent committing US\$50,000 [39,954 EUR] to the project. Industrializing countries were invited to participate for a US\$20,000 [15,982 EUR] commitment.

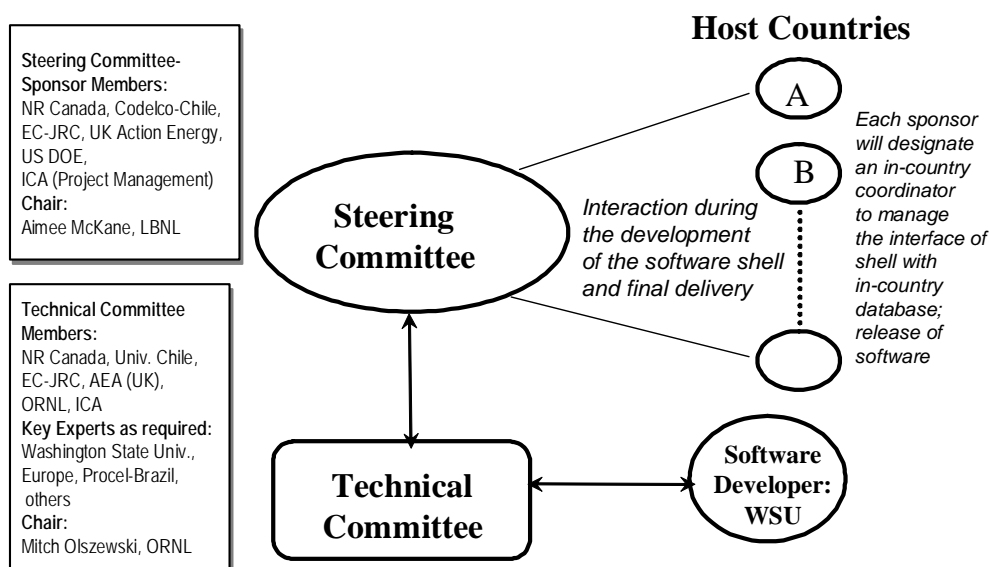
The first meeting to organize the project was held in February 2000 in Washington DC. In attendance were representatives from ETSU-UK, USDOE, Ministry of Economics of Chile (later represented by the Corporacion Nacional del Cobre de Chile), and the ICA, with each sponsor committing US\$50,000. As a result of this first organizing meeting,

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<sup>1</sup> Based on analysis conducted by Lawrence Berkeley National Laboratory, Energetics, and the Alliance to Save Energy July 2004

a Steering Committee and a Technical Committee were formed to direct the collaboration. The Steering Committee is comprised of sponsors who oversee the development work and make decisions on the launch, look and feel of the software tool. Sponsors also designate representatives to the Technical Committee, which creates project specifications, oversees the work of the software developer, and reports progress to the Steering Committee. The roles and responsibilities of both Committees and the Project Manager were summarized in writing as the result of this meeting.

The ICA became the project manager responsible for receiving and disbursing funding, entering into contracts, and carrying forward the business of the collaboration. After substantial discussion, the initial sponsors decided not to entertain financial participation by motor equipment manufacturers so that the ensuing software would be viewed as “product-neutral” on a global basis. The first meeting of the Technical Committee was also held in February 2000, during which the work on a specification for the international software was begun. Figure 1 provides an overview of the organizational structure.



**Figure 1: Organization Chart - International Motor Software Project**

During the course of the software development, the European Union (European Commission-Joint Research Centre or EU-JRC) and Natural Resources Canada (NR Canada) joined the collaboration, with each providing substantial financial as well as in-kind contributions. These additional sponsors expanded the scope of the project in several ways that are described in the next section.

### 3 Designing IMSSA

The first step in developing what is now known as the International Motor Selection and Savings Analysis (IMSSA) software tool was to develop a specification. An initial set of deliverables was identified prior to the first Steering Committee meeting and then refined as a result of the Steering and Technical Committee meetings. The Technical Committee developed a specification and the collaborative issued a request for proposal to select a contractor to complete the work.

#### Mission

The purpose of the International Motor Software Project is to:

- encourage greater use of energy efficient industrial electric motors; and
- increase awareness of motor system efficiency worldwide.

We will do this by creating a software tool that provides industrial users of motor systems with greater access to performance and decision-making information concerning energy efficient motors systems.

#### Goals

- Create a flexible software shell that can accommodate, with a minimum amount of technical support, motor databases developed for specific motor markets (as initially determined by sponsors)
- Build on lessons learned and key features from existing motors software developed by the project sponsors and others
- Prepare a detailed manual in English and Spanish for sponsors and others to use in linking the software shell to specific motor databases
- Provide technical support required to successfully launch the software in the sponsors' designated markets
- Make the software broadly available under guidelines developed by the Steering Committee and build an awareness campaign for the software
- Seek ways to use the project collaboration to build and strengthen relationships, enhance trade opportunities, and improve communications and information transfer

The initial deliverables for the collaboration were identified as 1) a common motor management software shell that interfaces with each sponsor's database of motors 2) a detailed instruction manual and 3) technical support after launch of the software.

The Technical Committee performed due diligence by examining four existing motor software tools, including EURODEEM (EU), Evaluacion Energetica de Motores Electricos de Induccion (Mexico), EVAMOTOR (Chile), and MotorMaster+ (US). As the result of this work, the Committee determined that MotorMaster+ appeared to be the most comprehensive, while the EVAMOTOR software offered the user the option of either a rapid analysis or a more comprehensive analysis. Both the EURODEEM and Mexican software tools appeared to be based around MotorMaster+ principles.

The Technical Committee decided to develop both the shell and the users manual in English and Spanish, with the Spanish-language work occurring through arrangements with the Chilean Ministry. Later on, French was added.

Anticipated users of the software include:

- project or facility engineers at industrial plants
- operators with limited technical knowledge on motors
- equipment suppliers and distributors
- engineering professionals and energy service companies

Prior to the contractor beginning development of the shell, the sponsors decided to survey selected end users to determine the key features desired in the software. This was accomplished by assembling a focus group and providing a demo of the current version of MotorMaster+, and by describing other possible features.

### 3.1 Key Features of the Software Shell

The committee agreed to pursue both a rapid analysis function (a feature of EVAMOTOR) and a comprehensive capability (a feature of MotorMaster+). An introductory estimating tool to attract interest in further analysis was also considered desirable, but later dropped from the project because of difficulty obtaining the rights to an existing estimator product.

A specification was developed and a Request for Proposal issued. Key capabilities of the software include:

- able to display operating parameters and specifications for both North American (NEMA) and metric (IEC) motors;
- capable of accepting and using data from motor manufacturers' databases containing full and part-load efficiency values taken in accordance with the NEMA IEEE 112 testing protocol or IEC 60034-2;
- capable of containing multiple motor manufacturers' databases for three-phase motor models. Motor performance data may be referenced to the IEEE test protocol, the IEC protocol, or be submitted for both. The database and the software have the capability of containing and displaying motors varying from 1 to 500 hp for the 60 Hz models and from 0.75 to 370 kW for 50 Hz service;
- multi-language capability (with the initial version developed in Spanish and English) and ability to display and conduct economic analyses using local currencies;
- allows users to insert applicable import tariffs, efficiency standards, and motor efficiency and list price default values, and
- permits user entry of country-specific motor repair and replacement cost defaults and estimates of motor rewind-related efficiency losses.

Key features include:

- Splash Screen which provides users with the ability to select their preferred language, motor operating frequency, motor efficiency test standard and currency;
- Motor Selector which allows a user to conduct energy-efficient motor savings analyses without ever accessing the main body of the software package; and
- Detailed Motor Analysis, which allows the user to compare the annual running cost of an existing standard efficiency motor model with that of an energy-efficient model. The module allows the user to determine cost-effectiveness for "New Purchase," "Repair-versus-Replace," and "Replace Existing Motor" scenarios.

Other features include user-entered Electricity Rate Schedules, Financial Analysis, and Motor Rebate Program modules.

After considering several contractors, the Technical Committee recommended and the Steering Committee accepted the proposal from Washington State University (WSU).

Due to funding limitations, the collaboration elected not to include the inventory and maintenance function in the initial software shell development.

The rights to the software are held jointly by ICA and WSU, with the understanding that the project sponsors (Steering Committee) will be consulted and approve any changes to the software beyond the original scope of work.

### **3.2 Providing an Environment for Standardization**

IMSSA is designed to provide a platform that helps facilitate harmonization of motor standards through the collection of motor performance data in a common format. IMSSA provides motor manufacturers, most of whom serve global markets, with a defined set of data fields that can be used to describe the features and efficiency of most motor types regardless of the country of origin or destination. It also provides policy-makers with ready access to motor performance for the purpose of determining requirements for energy efficiency labels. Because it provides the opportunity to access a large body of motor data reported in a common format and available from a single source, this standardized database format aids harmonization efforts. Although the software splash screen currently asks the user to select either IEEE- or IEC-tested motors and then calls up the appropriate database, if test standards become harmonized at some time in the future, these databases could readily be integrated.

### **3.3 Preparing for Launch**

The initial development of the IMSSA shell was completed in mid-2003. The shell was initially populated with a database of 25,000 North American IEEE-tested motors. However, during the development of the software shell, the European Union-JRC became increasingly involved in the collaboration and contributed their database of 7,200 IEC-tested motors for inclusion in IMSSA. Inclusion of these data and the ongoing commitment of the EU to work with European manufacturers to update these data was a significant contribution. In July 2003, Natural Resources Canada approached the collaboration with a request to join and an offer to fund some additional features such as:

- capability to enter demand charges based upon monthly peak kVA rather than kW readings;
- ability to convert energy savings (kWh/year) into greenhouse gas emission reductions (in pounds or kg per year). • Display emission reduction benefits on all appropriate on-screen displays and printed reports;
- addition of a French language module and supporting French-language software manual, and
- addition of Canadian currency and utility rate structures as selection options.

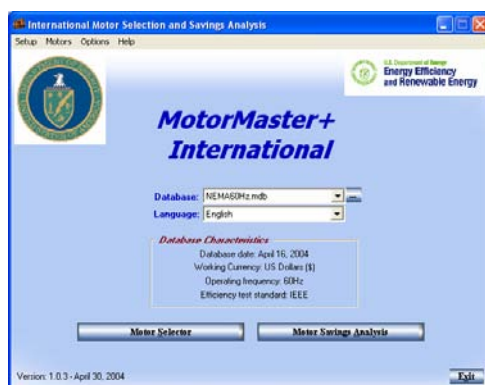
The enhanced software, including North American and European motor databases, was released to the sponsors for beta-testing in September 2003. Following the beta-test period, additional modifications were made to IMSSA and the final product was released to the sponsors for in-country launch in March 2004.

## 4 The IMSSA Experience

In keeping with the organizational plan for IMSSA, each sponsor is responsible for developing a program to release the software to their own constituencies. To date, three sponsors have released the software: Natural Resources Canada, U.S. Department of Energy, and Corporacion Nacional del Cobre de Chile.<sup>2</sup> In June 2004, the U.S and Canada organized a joint announcement at a conference of the Electrical Apparatus and Service Association (EASA), the largest trade association for motor distributors and rewind services in North America.

### 4.1 The U.S Experience

In 1993, the USDOE first launched a motor management tool, MotorMaster+, in cooperation with Washington State University. Since that time, USDOE, through its Industrial Technologies Program (ITP) has continued to refine and add features to MotorMaster+. Although MotorMaster+ is very popular, comprehensive, and includes many of the same features that are in IMSSA, USDOE elected to participate in the IMSSA collaboration as a way of pooling resources and knowledge to develop a truly international software tool. Additional features include: a 32-byte platform, a quickly accessed Motor Selector module, multi-language capability, and the ability to conduct repair/replacement analysis on a broader range of motors, which is particularly important to US companies with overseas operations who are interested in improving motor system efficiency.



After announcing the availability of MotorMaster+ International at the June 2004 Electrical Apparatus and Service Association meeting with colleagues from Canada, the USDOE made the software available online from the USDOE website as MotorMaster+International at [http://www.oit.doe.gov/bestpractices/software\\_tools.shtml](http://www.oit.doe.gov/bestpractices/software_tools.shtml).

USDOE also included a feature in the electronic newsletter, ITP E-Bulletin, which goes out to more than 10,000 industrial readers. To date, approximately 1400 copies of MotorMaster+ International have been downloaded. The distribution figures are expected to increase substantially when the tool is included on the 'Decision Tools for Industry'

<sup>2</sup> During the development of IMSSA, the UK sponsorship transitioned from ETSU to the UK Action Energy (Carbon Trust), which has not developed any plans for the software release. EU plans are pending.

CD. MM+ International is also being incorporated into the ITP Motor Systems training curricula. Interactive web-based demonstrations of the tool are planned in 2006.

To accommodate existing users of MotorMaster+, USDOE continues to make both software products available until such time as the Inventory Management, Batch Analysis, Energy Accounting - Savings Validation / Tracker, and Maintenance Logging features (currently included in MotorMaster+) are incorporated into MotorMaster+ International. Discussions concerning an IMSSA 2.0 that would include these features are already underway.

## 4.2 The Canadian Experience

IMSSA is sponsored by National Resources Canada under the Office of Energy Efficiency's EnerGuide for Industry initiative, which provides information and tools to help energy-wise companies make better educated, more energy-efficient selections when purchasing "off-the-shelf" equipment for their specific applications. For the Canadian market, IMSSA is branded CanMOST (Canadian Motor Selection Tool) and OSMCan (Outil canadien de sélection des moteurs au Canada) in French. Canadian requirements added to IMSSA include: a French language version, the ability to handle Canadian utility rate structures and rebate schemes, prices in Canadian dollars, the calculation of greenhouse gas emissions, and the addition of some 575 volt motors available only in Canada.

Officially launched in June 2004, CanMOST was made available for download from EnerGuide for Industry's Website (<http://egi.gc.ca>) in November of that year. A number of approaches have been taken to reach the target audience of industry decision makers and buyers:



At launch time public relations were used to reach a large audience, increase awareness of the initiative, and encourage trial. A press release was issued, and an article was placed in trade press.

In the spring of 2005, a direct mail piece was inserted into the highest circulation English and French industry publications (total reach 50,000). In the same timeframe 3,000 CanMOST CDs were mailed to purchasers of an Electric Motor Handbook (The Electricity Forum, 2004).



Participation at specific large industry trade shows (namely manufacturing and pulp and paper) with strategic partners such as utilities, have allowed for brief but personal interaction with key target audience segments, such as plant design and maintenance people, or a specific industry sector.

CanMOST is constantly being presented at various forums (industry sector task forces, energy efficiency conferences, industrial information sessions, motor workshops...). These are a good opportunity for in-depth presentations to smaller but highly receptive groups.

As of March 2005, in addition to the 3,000 CD's mailed, there were 427 unique downloads of CanMOST from the Website, 369 of these originating from Canada. Public opinion research is currently under way (May 2005) to gauge users' level of satisfaction with the software and identify any barriers to use, as well as assess the need for a second generation of CanMOST that would add motor inventory management, batch analysis, energy accounting and maintenance logging capabilities.

Next for CanMOST promotion is to step up the collaborative work already under way with electrical utilities, to increase the demand for premium efficiency motors and offer CanMOST as a unique tool to help identify those best suited to specific applications. Namely, CanMOST will be used by Hydro-Québec, one of Canada's largest electric utilities, as a selection tool for a premium motor incentive program. One-day workshops the overall benefits of premium efficiency motors are also being developed to increase awareness and uptake by industry.

### 4.3 The Chilean Experience

In Chile, on 25 November 2004, CODELCO and the Comisión Nacional de Energía (CNE) launched their customized version of IMSSA. A workshop was held which was well-attended. Work has also started on dissemination within Spanish speaking Latin America



## 5 Next Steps

As the launch of IMSSA proceeded, the Steering Committee continued to meet and discuss issues concerning the long-term support of the software. During development,

the original vision of the software- that of a common shell with country-specific databases maintained by the host countries- was modified slightly. The new vision of IMSSA is that of a common software shell that comes loaded with North American, European, and any other national or regional motor databases submitted by sponsors. Users can select which databases to access when using the software. The North American and European databases are maintained with the software through ongoing in-kind support of USDOE and the EU.

The Steering Committee arranged for ongoing limited technical support from WSU in order to support sponsors who are trying to deal with non-routine technical problems. In addition, WSU will also provide software support as required to maintain the functionality of the software.

The Steering Committee has also decided to invite government agencies or non-governmental organizations (NGOs) that would like greater involvement to become sponsors at a lower cash investment than the founding sponsors. New sponsors would include organizations that agree to invest in the expansion of the capabilities of the existing software by adding a language and/or a motor database customized for use by a country. Sponsors will also have the opportunity to influence the future direction of IMSSA through participation in the collaborative decision making process and are recognized on the splash screen. A description of the benefits of sponsorship is available.

Finally, the Technical Committee has developed a specification for additional features, including Inventory Management, Batch Analysis, Energy Accounting - Savings Validation / Tracker, and Maintenance Logging. The Steering Committee will be reviewing the cost and merits of these additional features over the next few months and deciding on additional development.

With the participation of additional countries, especially in Asia and the Indian subcontinent, IMSSA has the potential of becoming a truly global motor selection and savings analysis tool. By doing so, the IMSSA collaborative will be well on its way to achieving its goals of 1) encourage greater use of energy efficient industrial electric motors, 2) increasing awareness of motor system efficiency worldwide, and 3) creating an environment in which harmonization of motor standards is encouraged.

## 6 References

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